Appendix C from the NoName Group Report to CALFED

The following is a draft list of possible CALFED Stage 1 measures related to the operation of the Projects that can affect water quality. The context of the NoName Group contribution to water quality measures must first be explained. There are 3 analysis areas related to CALFED Stage 1 that need to be considered during an overall assessment of water quality in Stage 1.

1. The effect from common programs such as source control, watershed management, land-use change programs, removal/treatment/movement of ag drains, etc..
2. The effect from operations-related quality programs (discussed in the NNG)
3. The effect from other CALFED measures not necessarily related to quality (Banks PP relaxation, more VAMP, etc...). This is still outstanding to some degree.

The NoName Group contribution refers to the second point. Measures that improve water quality represent four kinds of operational changes:

- those that affect delta water quality for in-delta users,
- those that involve operations of the Projects to reduce salinity (TDS, bromide, chloride) and organics in water exported from the delta,
- operational changes that would improve water quality of deliveries to urban contractors, and,
- transfers and exchanges to match water quality with relevant standards.

Source control measures are being developed in other CALFED forums (notably, the Water Quality Workgroup). Any and all ties to water supply/environmental impacts should be highlighted in each description. A sharing formula for environmental, water supply and WQ needs to be worked out and it clearly applies to almost all the NoName Group tools so far collected.

In dry years there may be limited opportunities to move water around for quality enhancement for urban agencies with the given infrastructure if supply is not to be risked. Timing of transfers could be optimized for quality, though (capacity would be available).

A. In-Delta water quality enhancement actions

Hood diversion -- This diversion facility could be operated at times when the cross channel gates are closed - or more frequently if fish are not present near the screens. A diversion rate of approximately 2,000 cfs may be adequate to protect/mitigate for in-delta water quality degradation that may occur when the cross channel gate is closed.

Benefits: In-Delta diverters and exports could receive better source water including lower bromide concentration. North Bay Aqueduct contractors will probably not be adversely affected by a small diversion from Hood. Overall, the benefit to the North Bay Aqueduct contractors from the cross channel gate closure will probably improve quality in Cache Slough.

Issues/Concerns: The diversion capacity and frequency of use of the Hood diversion facility will need to be determined based on screening efficiency and fish density near the intake. Lower Mokelumne fishery concerns (e.g., mixed migratory cues) will need to be addressed.

Cost: Estimated at $77 million in the CALFED Phase II Interim Report.

Adjusted minimum outflows in the fall -- Minimum outflow could be increased by 500 to 1,000 cfs in September, October and/or November. A 500 cfs increase to net Delta outflow could lower chlorides by about 50-70 mg/L in the south Delta. These estimates are based on G-model calculations for steady-state outflow increasing from 3,500 to 4,000 cfs. Corresponding reductions to bromide concentration can also be expected.

Benefits: In-Delta diverters and exporters could receive supplies with lower TDS and bromide concentration. Increased outflow may also help the ecosystem during these fall months (e.g., out-migrating Sacramento spring-run).

Issues/Concerns: The water cost and source need to be weighed against the quality benefits.

Costs: None, aside from the water costs.

B. Improved export water quality (within-Project)

San Luis operations (shifting of exports to times of high flow) -- At present, the filling of San Luis Reservoir begins in the fall, sometimes before the onset of major rains which flush salt out of the Delta. A simple operational and modeling parameter to improve delivered water quality would be to refrain from exporting water to storage until X2 is west of Collinsville.

Benefits: This measure could lower TDS and bromide in San Luis Reservoir and therefore benefit the contractors that receive water from San Luis Reservoir.

Issues/Concerns: There is an increased risk of not filling San Luis (which could be offset by NNG water supply measures). Exports could not be shifted to a high-quality period with high entrainment potential.

Cost: None.

Releasing poor quality water in San Luis Reservoir in wet years -- Water that is exported at times of poor Delta water quality could be released into the San Joaquin River if Delta water quality improves and assurances were in place to recover the exports. This is a variation on SDWA's re-circulation proposal but with a view of augmenting fish

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flows with water that might contain higher bromide concentration (relative to the Delta) in order to vacate storage space in San Luis Reservoir to store higher-quality Delta water.

Benefits: Improves quality in San Luis Reservoir and blend to contractors receiving water from San Luis Reservoir and the joint reach of the California Aqueduct.

Issues/Concerns: This measure will also be limited by the relatively slow release/fill rate of San Luis Reservoir. To maximize the full water quality benefit, 100-500 TAF will need to released before an equal amount is refilled. There will be some water supply reliability risk associated while this method. There will be additional pumping costs as San Luis Reservoir is refilled (some costs could be recovered by producing on-peak power from San Luis releases prior to refilling). Spilling water into the San Joaquin River may have imprinting problems for San Joaquin River migratory fish.

Cost: Additional power costs.

Utilization of Joint-Point for water quality -- The CVP-Tracy export water is consistently lower in quality because of its plumbing limitations. Tracy PP draws directly from Old River throughout the tidal cycle, and therefore draws lower quality San Joaquin water which gets mixed with SWP water at O'Neill Forebay and San Luis Reservoir. The SWP operates CC Forebay mostly on the higher (flooding) tides, so it gets a slightly better mix of Sacramento River water. With unlimited joint-point flexibility, there are times when exports could shift from Tracy to Banks to achieve a better quality at O'Neill without losing any water.

Benefits: Could improve TDS and bromide concentration of CVP and SWP exports.

Issues/Concerns: It will be difficult to quantify the quality benefits, especially when/if south Delta barriers are in place (because circulation patterns may differ). Also, if the CVP shifts more pumping to Banks PP, Banks PP could receive more San Joaquin River water which could degrade export quality.

Cost: Cost associated with JPOD

Central Delta intake -- The outline and operation of this facility are described more thoroughly in the NoName Group report to CALFED on Stage 1 implementation. As a water quality measure, this new intake could be used to selectively export water from the Delta based on quality by alternating between the south and central Delta. The facility could also be linked with in-Delta storage. Diversions would be screened.

Benefits: Improved export water quality (lower concentrations of TDS and bromide)

Issues/Concerns: Will require new conveyance and screening facilities in the Delta. This concept is still highly preliminary; a limited amount of analysis has been completed on the water quality and entrainment benefits.

Cost: The intake and screening design and construction will represent the bulk of the costs. Costs could be estimated from the Clifton Court Forebay screens and Hood intake design work.

In-Delta Island Storage -- The general concept would be to divert surplus water on to Delta islands for storage. Operations would be restricted to ensure that diverted water was sufficiently low in TOC and bromide.

Benefits: Could lower bromide in export water if diversions to storage are made when ambient water is low in bromide and then exported when Delta outflow is low.

Issues/Concerns: Major increased TOC concentration concerns from urban water agencies because of the potential to increase harmful disinfection byproducts. The storage of water on islands lined with peat soil may increase dissolved TOC. Permitting of this project has just been delayed by the SWRCB because of cost and water quality concerns and the absence of willing buyers for the water.

Cost: High

C. Improving delivered water quality to sensitive users.

Circumventing San Luis -- The concept would be to circumvent San Luis Reservoir for urban deliveries when quality in San Luis Reservoir quality is relatively poor. Presently, without an O'Neill bypass operations cannot send higher quality water to the joint reach of the California Aqueduct without mixing in O'Neill Forebay. The bypass could allow releases from San Luis Reservoir to be made to the lower DMC and to the Mendota Pool without mixing with higher quality Delta exports. Note that the joint reach also must deliver a substantial amount of agricultural water to KCWA and WWD in addition to the large urban supplies to Southern California. Delivering water to urban agencies outside of the peak irrigation period is one way of further separating these supplies.

Selective withdrawals from San Luis Reservoir could also be utilized if an O'Neill bypass were built. For example, when water quality in San Luis Reservoir is worse than the Delta and both are being used for deliveries, the high-quality water could be routed into the joint reach while sending the lesser quality water into the lower DMC.

Benefits: Southern California urban agencies could benefit from selectively

Issues/Concerns: The water quality benefits would have to justify the cost of the bypass project. Selective usage of the Delta and San Luis Reservoir sources for urban usage would increase the salt load to the San Joaquin Valley.

Cost: $10-30 million (low-end cost would involve a simple "liner" through O'Neill Forebay, the high-end cost would involve a 11,000-13,000 cfs open concrete-lined

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channel around the Forebay, 2 miles in length)

Enlarged Pacheco Reservoir -- Pacheco Reservoir is a small (approximately 6,000 acre-feet) reservoir located west of San Luis Reservoir that captures local runoff from Pacheco Creek for local agricultural use. The reservoir is fairly close, though not currently connected, to the Pacheco Conduit, a San Felipe Division facility. This conduit currently delivers M&I and agricultural water from San Luis Reservoir to two CVP contractors, Santa Clara Valley Water District (SCVWD) and San Benito County Water District. The enlarged reservoir storage capacity ranges from 150 KAF to 400 KAF.

Benefits: In addition to providing storage for higher quality water selectively diverted from San Luis Reservoir (or the California Aqueduct), the expanded facility could have the additional benefit of helping to resolve the "low-point" problem in San Luis Reservoir. Currently, in order to keep SCVWD's CVP urban supplies on-line in the summer months, San Luis storage has to be kept above 150,000 AF. If there was alternative storage, San Luis could potentially be dropped at least another 100,000 AF in the summer, resulting in greater storage potential/water supply benefits. The additional storage in Pacheco would presumably free up storage that would otherwise be taken up in San Luis Reservoir so average deliveries could increase. The project could also increase the emergency storage available to SCVWD and others.

Issues/Concerns: Local environmental issues related to the expansion of the reservoir. The cost effectiveness of quality and supply reliability improvements need evaluation.

Cost: SCVWD has performed feasibility studies of the Pacheco expansion project. Construction and engineering costs are roughly $300-350 million, not including environmental mitigation.

SCVWD-San Luis Reservoir Bypass -- If high-quality urban supplies bypass San Luis Reservoir, SCVWD water quality from the CVP San Felipe Unit could degrade. A connection from the California Aqueduct could be built to the San Felipe Division (about 15 miles of pipeline at about 250-300 cfs) to avoid this problem.

Benefits: This facility could allow SCVWD to receive water from San Luis Reservoir or the California Aqueduct (which ever had better quality), would avoid the "low-point" quality problem in San Luis Reservoir for SCVWD and would avoid the supply "low-point" problem for other contractors (by effectively increasing San Luis Resevroir storage capacity). Combination with the Pacheco Reservoir expansion would greatly increase the quality improvement potential.

Issues/concerns: Quality improvements need to justify the cost. Other SWP and CVP operations may affect the ability of this bypass (either positively or negatively). Prediction and control of imported quality could be difficult without firm agreements with Project operators.

Cost: An approximate cost estimation is $3 million/mile for pipeline material and installation of this capacity. Land purchases could be minimized through right-of-way agreements.

Restructured SCVWD intake -- This concept involves modifying the intake in San Luis Reservoir to the San Felipe facilities. Because of the elevation of the intake, water quality is a concern when reservoir storage decreases to 300 TAF.

Benefits: Benefits include improved quality and supply reliability for SCVWD. In addition, more of San Luis Reservoir capacity could be utilized to the benefit of other CVP and SWP contractors.

Issues/Concerns: Few, except cost effectiveness.

Cost: $10-30 million (estimate).

Demand shift/conjunctive use in Southern California -- The concept would be to 1) pump more high-quality Delta water to Southern California when low bromide conditions occurred and less when quality was degraded by taking advantage of local storage options and/or 2) store high-quality water in storage near the Delta when it arrived and then deliver it to Southern California for consumption or storage in local facilities. Both methods would be most effective when deliveries were made during the off-irrigation season when the California Aqueduct can be utilized more exclusively by urban agencies.

Benefits: Lower TDS and bromide concentrations in deliveries to Southern California.

Issues/Concerns: SWP deliveries to southern urban agencies are restricted by a number of factors including available supply, conveyance capacity, contract and other institutional restrictions, and power costs. The usage of local storage facilities for water quality purposes through demand/delivery shifting may not be possible due to other commitments/restrictions. A few urban agencies in Southern California may completely lack to local storage/conjunctive use facilities. The tradeoffs between improved quality and the decrease in local storage flexibility and operation costs need to be evaluated.

Cost: Costs would involve local incentives for conjunctive use and re-operation as well as Project-wide re-operation costs. These costs may involve pumping reimbursement for groundwater use, lost revenue from power generation, and new conveyance and storage projects that would assist this measure.

Existing Los Vaqueros Reservoir -- The existing LVR could have limited water (5-15 TAF) available for CALFED depending on operations and assurances. Connection with EBMUD conveyance facilities could ensure high-quality replenishing water if LVR releases were made for CALFED supply or ecosystem purposes.

Benefits: In exchange for the storage of high-quality blending water in Los Vaqueros

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(which could benefit CCWD, EBMUD, and possibly South Bay Aqueduct contractors with small conveyance improvements), CALFED could utilize some storage in Los Vaqueros for water supply reliability (urban agencies could pre-bank water in Los Vaqueros and therefore pump less in drier periods) or ecosystem purposes. Small conveyance facility improvements could enhance the benefits to CALFED and urban agencies.

Issues/Concerns: Concerns are few, however, the benefits of this project would need to be weighed against the minor construction costs and planning efforts.

Cost: Small, unless conveyance improvements are used to more effectively use the existing storage. $3 million/mile for 300-500 cfs pipeline is a good estimate for pipeline costs assuming right-of-way agreements can be secured.

Enlarged Los Vaqueros Reservoir -- The water quality benefits of storing high-quality water in a separate, isolated storage facility south of the delta have been widely recognized. The enlargement of Los Vaqueros Reservoir (from 100 TAF to 400 TAF) has undergone some planning effort. Analyses related to the water quality benefits to urban agencies (besides CCWD) are still preliminary.

Benefits: This project could benefit water quality, supply and the ecosystem depending on the operating rules. Water quality benefits could accrue for CCWD, SCVWD, and to a lessor extent, MWD, depending on other infrastructure and operating rules. Results from preliminary water quality analyses showed that quality gains to Southern California were modest due to the mixing that occurs south of San Luis Reservoir. The gains begin to rise when SCVWD is directly connected to the high quality reservoir (either through a California Aqueduct-San Felipe Unit connection or an expansion of the South Bay Aqueduct with a direct connection to Los Vaqueros Reservoir). It may be possible for MWD to benefit more if a larger portion of their deliveries are shifted into the winter. High-quality water could be stored in LVR when it arrived in the Delta and then sent south outside of the peak irrigation season. An enlarged LVR could also provide ecosystem benefits because pumping could be immediately halted while exports continued from pre-banked water in LVR.

Issues/Concerns: Local environmental concerns related to the larger inundation area and new conveyance facilities need to be addressed.

Cost: The estimate for an expansion to 400 TAF is about $700 million.

D Water Exchanges or Transfers for Water Quality

Pine Flat and Millerton exchanges -- Pine Flat and Millerton reservoirs contain water of exceptional quality beyond any reliable level from the Delta. When water is released from Friant Dam into the San Joaquin River channel to accommodate flood control needs, some water could be diverted into the Cross Valley Canal and delivered into storage in the MWD service area, Eastside Reservoir, groundwater basins, etc. This water should reduce the quantity of water that MWD requires from the Delta in a given year. In dry periods, when delta water quality is significantly degraded due to very low inflow, options might be exercised to purchase water and transport it for delivery to MWD or other contractors. During flood conditions this measure is already being utilized.

Development of a Mid-Valley Canal or other facility to deliver Delta water to the Friant Water Users could enable frequent trading of high quality drinking water in exchange for monetary considerations and guaranteed delivery of suitable water for agricultural uses. Permanent trades could also be facilitated through improved water use efficiency or changes in cropping patterns.

In addition to the direct exchange benefits, availability of a Mid Valley Canal should open up a huge amount of groundwater storage potential, likely more than 1 MAF. The problem here would be with the water quality implications of the trades. The Tulare Basin already has an adverse salt balance and will eventually (several generations from now) be rendered unusable without removal of salts. While the focus in the Tulare Basin has been on water supply, this concept would substitute higher saline water for better quality water from local users on the east side of the valley that currently do not use Delta water for irrigation.

Benefits: SWP Southern California urban agencies would benefit from far greater water quality compared with south Delta supplies.

Issues/Concerns: Exchange agreements and assurances would be institutionally complicated and time consuming to negotiate without high-level policy support. Agriculture in the San Joaquin Valley would receive the incremental increase in salt load that the urban agencies were saving by taking the southern Sierra supplies.

Cost: High, would involve conveyance facilities in the valley to be fully utilized.

E Miscellaneous

NHI -- NHI is working on the feasibility of rewatering the SJR through a series of exchanges. Increased flows in the river would presumably reduce concentrations of pollutants in the south Delta.

CCSF/SCVWD/Tuolumne River/West-side SJR diverter -- The concept would be to exchange high-quality water from the Tuolumne River (delivered to SCVWD through existing CCSF conveyance facilities) for SCVWD's CVP water (delivered to a lower San Joaquin River diverter who could also be served by the DMC). This operation would reduce diversions from the lower San Joaquin River. The reduced diversions could be counted as part of the Tuolumne River obligation towards meeting Vernalis flow

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requirements (which is still underdetermined, per the SWRCB WQCP hearings). Quality issues would need to be addressed.

Bifurcation -- Bifurcating the California Aqueduct south of San Luis Reservoir to segregate urban and ag supplies south of the Delta.

Multiplexing – Multiplex water through the California Aqueduct (alternating high- and low-quality water deliveries to urban and agricultural contractors, respectively).

Desalination -- The cost of desalination is related to the salinity differentials desired. Some options include desalination of water that is relatively low in salinity. The salt could be rejected right at Clifton Court, however, some sort of drain may be need to deposit salts where they will do little harm and will not be recycled.

Organic reduction of TOC – This concept involves the use of biological systems to harvest organics (TOC) and is highly preliminary.

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